

May 19, 2006

Mr. Russell K. Snyder, Executive Vice President
ASPHALT ROOFING MANUFACTURERS ASSOCIATION
1156 15th Street NW, Suite 900
Washington, DC 20005

RE: Low Slope Roof Costs
Cool Roof Premiums

Dear Mr. Snyder:

This report presents the results of a “snap shot” survey we performed, of cost premiums associated with installing “cool” roofs as part of low-sloped membrane roof coverings on non-residential buildings in the State of California.

As defined by the 2005 California Energy Code, a “cool” roof is a roof covering or surfacing that has been tested and labeled by the Cool Roof Rating Council (CRRC) as having an initial solar reflectance of at least 0.70 and an initial thermal emittance of at least 0.75. Some low-sloped membrane roof systems achieve the required initial solar reflectance and thermal emittance with little or no modification. Many of the most commonly installed low-slope membrane roof systems, however, require the addition of special reflective coatings or granules to comply with the “cool” roof criterion.

We asked 5 non-residential roof contractors from across the State of California to provide us estimates of the installed costs for several low-sloped roof membrane systems both as “non-cool” installations and as “cool” installations. Two contractors were selected from the San Francisco Bay Area, and one each from Sacramento, Fresno, and Los Angeles.

Cost estimates were requested for various predefined configurations of the three most common low-sloped membrane roof coverings installed in California over both wood (combustible) and steel (non-combustible) decks. Table 1 lists the basic “non-cool” roof configurations.

Both steel and wood decks were considered since California has at least as many non-residential buildings with wood decks as it has non-residential buildings with steel decks. Roof membranes over wood decks were also considered separately since single ply roof membranes, when installed over wood decks (insulation below the deck) require additional protective layers (e.g., gypsum board) to achieve at least a Class B fire rating.

For each basic roof membrane configuration, costs were requested for both a “non-cool” and a “cool” roof option. In general, cool options for bituminous roof membranes included utilizing special cool factory-coated cap sheets in lieu of a conventional mineral surfaced cap sheet or included applying cool coatings in the field. Single ply roof systems utilizing white, single ply roof membranes were assumed to be inherently “cool”, not requiring a change to go from “non-cool” to “cool”.

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Cost Estimating Assumptions

The same table of roof systems and the same set of instructions were sent to each contractor. The following are selected excerpts from correspondence requesting the cost information

"Thank you for agreeing to provide some typical roof system installation cost information. The attached spreadsheet indicates the form of the needed cost information and the various different roof systems we are interested in. Provide cost information for as many of the indicated roof systems as you have bidding experience... Assume new roof installations, located within a 25 mile radius of the contractor's operations, typical commercial buildings (e.g. strip mall drug store), a simple rectangular roof shape covering 25,000 square foot, no parapets, 1/4:12 slope, bowl style drains and overflows, several self-contained roof top units, a manufacturer 10 year warranted system but DO NOT include the cost of the warranty in the roof system cost information. Assume insulation is installed as indicated but DO NOT include costs associated with the insulation in your roof system costs. Include typical related sheet metal costs."

"Selected Definitions and Other Comments

- *"Cool" refers to CRRC listed and labeled materials meeting the minimum values of 0.70 reflectance and 0.75 emittance.*
- *"Fire Rated" means the system has been tested and qualifies for a Class B or better external fire rating (ASTM E108). Include costs directly related to obtaining fire rated systems (e.g. FR products, thermal barriers over wood decks below single ply membranes).*
- *Information may be limited regarding the availability and costs of some indicated products (e.g., "cool" factory coated fiberglass cap sheets or "cool" coated smooth APP sheets). Provide cost estimates for labor and/or materials you are able to obtain."*

It should be noted that we obtained costs associated with applications of a white cementitious coating from one specialty contractor and added these costs to the costs we received from the 5 roof contractors.

Results

Tables 2 through 5 summarize the cost information we received.

Tables 2, 3, and 4 indicate the average installed cost for each roof system configuration and the "cool roof" cost premium associated with these average costs. Table 2 includes costs for built-up roof configurations. Table 3 includes costs for single ply roof configurations. Table 4 includes costs associated with modified bitumen roof systems. Footnotes:

*1 – Not Used.

*2 - Includes costs for conventional gravel aggregate/ballast, higher costs of optional pavers, mortar set tile, or soil "green" roofs not considered.

*3 – Not Used

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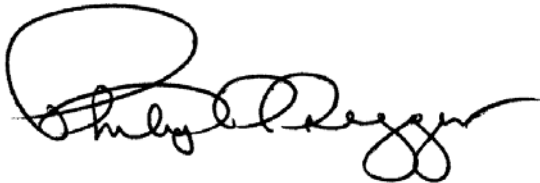
- *4 - Some factory coated products available but material pricing reportedly fluctuates greatly.
- *5 - Added installed costs associated with cementitious coatings all provided by one specialty roof coatings contractor.

Please note that the cost information is approximate in nature and should not be relied upon for project cost estimating.

Table 5 is a summary of the ranges of roof system costs and cost premiums by general roof system type and by location. The ranges of cost "premiums" relate to configuration to configuration comparisons and, therefore, do not necessarily track with the range of installed costs for that system type.

Sincerely,

PACIFIC BUILDING CONSULTANTS, INC.



Philip D. Dregger, PE, RRC, Principal
Professional Engineer (No. C045646)
Registered Roof Consultant (No. 0027)

PDD/bvd

enclosures: Table 1: "Non-Cool" Roof Configurations
 Table 2: Built-Up Roof Costs (Average of 5)
 Table 3: Single Ply Roof Costs (Average of 5)
 Table 4: Modified Bitumen Roof Costs (Average of 5)
 Table 5: Roof System Cost Range by Locale

Table 1 – “Non-Cool” Roof Configurations

Built-Up Membranes – Wood Decks

- Insulation below deck (insulation costs NOT INCLUDED)
- Nailed base, ply sheets adhered with hot asphalt, fire rated.
- Base, 3 Type IV ply sheets, and aggregate.
- Base, 2 Type IV ply sheets, and cap sheet.
- Base, 3 Type IV ply sheets, and asphalt/aluminum emulsion.

Built-Up Membranes – Steel Decks

- Insulation above deck (insulation costs NOT INCLUDED)
- Adhered with hot asphalt, fire rated.
- 3 Type IV ply sheets and aggregate.
- 3 Type IV ply sheets and cap sheet.
- 3 Type IV ply sheets and asphalt/aluminum emulsion.

Single Ply Membranes – Wood Decks

- Insulation below deck (insulation costs NOT INCLUDED)
- 45-60 mil, mechanically attached UNO, fire rated (include costs of required FR underlayments/thermal barriers).
- EPDM loose laid w aggregate ballast.
- EPDM fire rated membrane
- White CPE, CSPE, PVC, or TPO (assume “cool”)

Single Ply Membranes – Steel Decks

- Insulation above deck (insulation costs NOT INCLUDED)
- 45-60 mil, mechanically attached UNO, fire rated (include costs of required FR underlayments/thermal barriers).
- EPDM loose laid w aggregate ballast.
- EPDM fire rated membrane
- White CPE, CSPE, PVC, or TPO (assume “cool”)

Modified Bitumen Membranes – Wood Decks

- Insulation below deck (insulation costs NOT INCLUDED)
- Nailed base, ply sheets adhered with hot asphalt, fire rated (include costs of required FR sheets/thermal barriers).
- Base and 2 ply APP/SBS with aggregate ballast
- Base and 2 ply SBS with granulated cap sheet
- Base and 2 ply APP with granulated cap sheet
- Base and 2 ply APP with unsurfaced FR sheet
- Base and 2 ply APP with asphalt/aluminum emulsion

Modified Bitumen Membranes – Steel Decks

- Insulation above deck (insulation costs NOT INCLUDED)
- Ply sheets adhered with hot asphalt, fire rated (include costs of required FR sheets/thermal barriers).
- 2 ply APP/SBS with aggregate ballast
- 2 ply SBS with granulated cap sheet
- 2 ply APP with granulated cap sheet
- 2 ply APP with unsurfaced FR sheet
- 2 ply APP with asphalt/aluminum emulsion

TABLE 2 - BUILT-UP ROOF COSTS (AVERAGE OF 5)

NON-COOL ROOF OPTIONS		COOL ROOF OPTIONS		PREMIUM	
Roof Cover Type	Cost (\$/ft ²)	Roof Cover Type	Cost (\$/ft ²)	Cost (\$/ft ²)	Cost (%)
Built-Up Roof - Wood Deck	2.07-2.67	Built-Up Roof - Wood Deck	2.67-3.77	.37-1.10	15-46%
base, 3 plies, and aggregate	2.67	base, 3 plies, and aggregate + 200 mil "cool" cementitious coating (*5)	3.77	\$1.10	41%
base,3 plies and cap	2.07	base,3 plies and cap + "cool" acrylic coating	3.02	\$0.96	29%
		base,3 plies and cap + 20 mil "cool" cementitious coating (*5)	2.67	\$0.60	29%
		base,3 plies and cap w factory applied "cool" coating (*4)	3.01	\$0.94	46%
base, 3 plies, and asphalt emulsion + aluminum emulsion	2.50	base, 3 plies, and asphalt emulsion + "cool" acrylic coating	2.87	\$0.37	15%
Built-Up Roof - Steel Deck	2.15-2.61	Built-Up Roof - Steel Deck	2.75-3.71	.37-1.10	15-43%
3 plies and aggregate	2.61	3 plies and aggregate + 200 mil "cool" cementitious coating (*5)	3.71	\$1.10	42%
3 plies and cap	2.15	3 plies and cap + "cool" acrylic coating	3.06	\$0.91	43%
		3 plies and cap + 20 mil "cool" cementitious coating (*5)	2.75	\$0.60	28%
		3 plies and cap w factory applied "cool" coating (*4)	3.04	\$0.89	42%
3 plies and asphalt emulsion + aluminum emulsion	2.47	3 plies and asphalt emulsion + "cool" acrylic coating	2.84	\$0.37	15%

TABLE 3 - SINGLE PLY ROOF COSTS (AVERAGE OF 5)

NON-COOL ROOF OPTIONS		COOL ROOF OPTIONS		PREMIUM	
Roof Cover Type	Cost (\$/ft ²)	Roof Cover Type	Cost (\$/ft ²)	Cost (\$/ft ²)	Cost (%)
Single Ply - Wood Deck	3.05-3.85	Single Ply - Wood Deck	3.18-3.90	.00-.85	0-28%
EPDM loose laid w aggregate ballast (*2)	3.85	EPDM w "cool" ballast - None Available	NA		
EPDM "FR" membrane	3.05	EPDM w "cool" acrylic coating	3.90	\$0.85	28%
		White EPDM	3.25	\$0.20	7%
White CPE, CSPE, PVC or TPO	3.18	White CPE, CSPE, PVC or TPO	3.18	\$0.00	0%
Single Ply - Steel Deck	3.12-3.79	Single Ply - Steel Deck	3.42-3.85	.00-.73	0-24%
EPDM loose laid w aggregate ballast (*2)	3.79	EPDM w "cool" ballast - None Available	NA		
EPDM "FR" membrane	3.12	EPDM w "cool" acrylic coating	3.85	\$0.73	24%
		White EPDM	3.42	\$0.30	10%
White CPE, CSPE, PVC or TPO	3.28	White CPE, CSPE, PVC or TPO	3.28	\$0.00	0%

TABLE 4 - MODIFIED BITUMEN ROOF COSTS (AVERAGE OF 5)

NON-COOL ROOF OPTIONS		COOL ROOF OPTIONS		PREMIUM	
<u>Roof Cover Type</u>	<u>Cost (\$/ft²)</u>	<u>Roof Cover Type</u>	<u>Cost (\$/ft²)</u>	<u>Cost (\$/ft²)</u>	<u>Cost (%)</u>
Modified Bitumen - Wood Deck	3.03-4.88	Modified Bitumen - Wood Deck	4.19-5.41	.53-1.12	11-26%
MB w aggregate ballast (*)2	3.03	MB w "cool" ballast - None Available	NA		
w SBS granulated cap sheet	3.59	w "cool" Factory surfaced SBS granulated cap sheet (*)4	4.48	\$0.89	25%
		w SBS granulated cap sheet + "cool" acrylic elastomeric coating	4.37	\$0.79	22%
		w SBS granulated cap sheet + 20 mil "cool" cementitious coating (*)5	4.19	\$0.60	17%
w APP granulated cap sheet	4.20	w "cool" Factory surfaced APP granulated cap sheet (*)4	5.25	\$1.05	25%
		w APP granulated cap sheet + "cool" acrylic elastomeric coating	5.03	\$0.83	20%
w unsurfaced APP FR sheet	4.25	unsurfaced APP w asphalt emulsion + "cool" acrylic coating	5.38	\$1.12	26%
		w "cool" Factory surfaced APP sheet (*)4	5.22	\$0.97	23%
APP w asphalt emulsion + aluminum emulsion	4.88	APP w asphalt emulsion + "cool" acrylic coating	5.41	\$0.53	11%
Modified Bitumen - Steel Deck	3.31-4.79	Modified Bitumen - Steel Deck	4.15-5.36	.57-1.24	12-31%
MB w aggregate ballast (*)2	4.13	MB w "cool" ballast - None Available	NA		
w SBS granulated cap sheet	3.55	w "cool" Factory surfaced SBS granulated cap sheet (*)4	4.39	\$0.84	24%
		w SBS granulated cap sheet + "cool" acrylic elastomeric coating	4.58	\$1.03	29%
		w SBS granulated cap sheet + 20 mil "cool" cementitious coating (*)5	4.15	\$0.60	17%
w APP granulated cap sheet	3.98	w "cool" Factory surfaced APP granulated cap sheet (*)4	4.89		
		w APP granulated cap sheet + "cool" acrylic elastomeric coating	4.81	\$0.83	21%
w unsurfaced APP FR sheet	4.04	unsurfaced APP w asphalt emulsion + "cool" acrylic coating	5.07	\$1.03	25%
		w "cool" Factory surfaced APP sheet (*)4	5.28	\$1.24	31%
APP w asphalt emulsion + aluminum emulsion	4.79	APP w asphalt emulsion + "cool" acrylic coating	5.36	\$0.57	12%

TABLE 5 - ROOF SYSTEM COST RANGE BY LOCALE

NON-COOL ROOF OPTIONS		COOL ROOF OPTIONS		PREMIUM	
<u>Roof Cover Type</u>	<u>Cost (\$/ft²)</u>	<u>Roof Cover Type</u>	<u>Cost (\$/ft²)</u>	<u>Cost (\$/ft²)</u>	<u>Cost (%)</u>
Built-Up Roof - Wood Deck	1.50-2.84	Built-Up Roof - Wood Deck	1.88-4.79	.17-1.95	9-69%
Fresno	2.25-2.77	Fresno	2.87-3.87	.28-1.10	11-40%
Los Angeles	2.84-3.20	Los Angeles	3.44-4.79	.49-1.95	16-69%
Sacramento	1.50-2.32	Sacramento	1.88-3.23	.17-1.10	9-65%
SF Bay (1)	1.86-2.52	SF Bay (1)	2.37-3.62	.30-1.10	12-44%
SF Bay (2)	2.07-2.73	Bay (2)	2.67-3.83	.60-1.10	24-50%
Built-Up Roof - Steel Deck	1.50-3.40	Built-Up Roof - Steel Deck	2.07-4.60	.17-1.60	9-57%
Fresno	2.38-2.72	Fresno	2.98-3.72	.28-1.10	10-42%
Los Angeles	3.01-3.40	Los Angeles	3.50-4.60	.49-1.60	16-53%
Sacramento	1.50-2.32	Sacramento	2.07-3.42	.17-1.10	9-57%
SF Bay (1)	1.93-2.24	SF Bay (1)	2.25-3.21	.30-1.10	13-52%
SF Bay (2)	1.92-2.58	SF Bay (2)	2.52-3.68	.60-1.10	26-54%
Single Ply - Wood Deck	1.98-5.24	Single Ply - Wood Deck	1.98-5.60	.00-1.07	0-35%
Fresno	2.24-3.05	Fresno	2.24-3.87	.00-1.00	0-35%
Los Angeles	4.11-4.70	Los Angeles	4.53-5.60	.00-1.07	0-24%
Sacramento	1.98-3.24	Sacramento	1.98-2.99	.00-.77	0-35%
SF Bay (1)	2.66-5.24	SF Bay (1)	2.91-3.65	.00-.59	0-22%
SF Bay (2)	2.98-3.61	SF Bay (2)	3.31-3.79	.00-.81	0-27%
Single Ply - Steel Deck	1.56-5.24	Single Ply - Steel Deck	1.56-5.25	.00-1.05	0-41%
Fresno	2.28-3.08	Fresno	2.28-3.94	.00-1.00	0-34%
Los Angeles	4.20-4.35	Los Angeles	4.20-5.25	.00-1.05	0-25%
Sacramento	1.56-2.82	Sacramento	1.56-2.54	.00-.74	0-41%
SF Bay (1)	2.66-5.24	SF Bay (1)	2.91-3.65	.00-.59	0-22%
SF Bay (2)	3.52-4.58	SF Bay (2)	4.29-4.80	.00-.80	0-20%
Mod. Bit. - Wood Deck	2.92-6.20	Mod. Bit. - Wood Deck	3.58-6.58	.15-1.32	4-29%
Fresno	3.23-4.43	Fresno	3.83-4.72	.29-1.05	7-29%
Los Angeles	4.39-6.20	Los Angeles	4.99-7.5	.60-1.60	14-33%
Sacramento	2.92-3.85	Sacramento	3.58-4.13	.15-.92	4-29%
SF Bay (1)	3.46-5.81	SF Bay (1)	4.05-6.58	.42-1.32	7-26%
SF Bay (2)	3.61-4.31	SF Bay (2)	4.21-5.1	.49-1.12	12-28%
Mod. Bit. - Steel Deck	2.66-6.40	Mod. Bit. - Steel Deck	3.26-7.35	.15-1.73	4-44%
Fresno	2.66-3.78	Fresno	3.26-4.06	.28-.98	7-32%
Los Angeles	4.55-6.40	Los Angeles	5.20-7.35	.60-1.70	12-37%
Sacramento	3.11-4.04	Sacramento	3.76-4.32	.15-.91	4-27%
SF Bay (1)	3.56-5.88	SF Bay (1)	4.16-6.15	.42-1.48	7-33%
SF Bay (2)	3.55-4.25	SF Bay (2)	4.15-5.65	.60-1.73	17-44%